



MACHAKOS UNIVERSITY

University Examinations for 2020/2021 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

SECOND YEAR SPECIAL/ SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 208: STRENGTH OF MATERIALS II

DATE: 25/3/2021

TIME: 8.30-10.30 AM

INSTRUCTIONS

- This paper comprises of five questions. Answer **three** questions
- Question one is **compulsory** and carry 30 marks
- Answer any other **two** questions

QUESTION ONE (30 MARKS)

- a) A timber beam 100mm wide and 200mm deep is to be reinforced by bolting on two steel flitches each 150mm by 12.5 mm in section. Calculate the moment of resistance in the following cases :
- i. Flitches attached symmetrically at the top and bottom
 - ii. Flitches attached symmetrically at the sides
- Allowable stress in timber is 6N/mm^2 . What is the maximum stress in the steel in each case?
Take $E_s=2 \times 10^5\text{N/mm}^2$ and $E_t=1 \times 10^4\text{N/mm}^2$. (15 marks)
- b) Briefly discuss any **THREE** theories of failure. (15 marks)

QUESTION TWO (20 MARKS)

Check the stability of the reinforced concrete retaining wall shown in fig 1. The soil is a silty sand with a horizontal surface and no surcharge. The water table lies below the base. The wall was propped while the backfill was placed using only light compaction. Assume the virtual support face is vertical. Soil properties $c=0$, angle of friction 40° , $\gamma_{\text{soil}}=20\text{Kn/m}^3$ and $\gamma_{\text{concrete}}=24\text{kn/m}^3$ (20 marks)

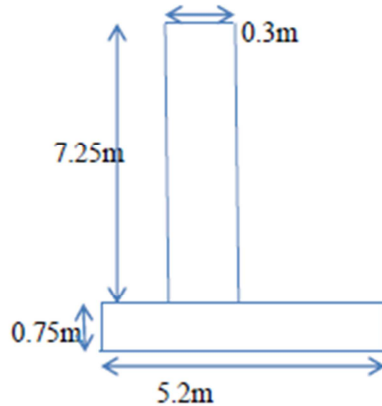


Fig 1.

QUESTION THREE (20 MARKS)

A column of circular section is subjected to a load of 120kN. The load is parallel to the axis but eccentric by an amount of 2.5mm. The external and internal diameters of columns are 60mm and 50mm respectively. If both the ends of the column are hinged and column is 2.1m long, then determine the maximum stress in the column. Take $E=200\text{gn/m}^2$

QUESTION FOUR (20 MARKS)

A hollow rectangular column of external depth 1m and external width 0.8m is 10cm thick. Calculate the maximum and minimum stress in the section of the column if a vertical load 200kN is acting with an eccentricity of 15cm.

QUESTION FIVE (20 MARKS)

- a) A short column of external diameter 40cm and internal diameter 20cm carries an eccentric load of 80kN. Find the greatest eccentricity which the load can have without producing tension on the cross section (10 marks)

- b) If in problem (a) above the eccentricity of the point load is given as 150mm, then calculate the maximum and minimum stress in the section (10 marks)